CLAIMS

We claim:
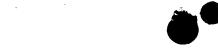
1. A method for early detection of subacute, potentially catastrophic infectious illness in a premature newborn infant comprising:

(a) continuously monitoring heart rate variability in the premature newborn infant; and

(b) identifying at least one characteristic abnormality in the heart rate variability that is associated with the illness.

2. The method of claim 1, wherein the illness is sepsis.

3. The method of claim 2, wherein antibiotic therapy is initiated and a diagnostic work-up for the illness, comprising obtaining a blood culture from the newborn infant, is provided when the at least one characteristic abnormality is identified.

4. The method of claim 1, wherein the illness is necrotizing enterocolitis.

5. The method of claim 4, wherein a diagnostic work-up for the illness, comprising an X-ray of the newborn infant or a pathological specimen from the newborn infant, is provided when the at least one characteristic abnormality is identified.

6. The method of claim 1, wherein the illness is selected from the group consisting of pneumonia and meningitis.

7. The method of claim 1, wherein the at least one characteristic abnormality is identified from a normalized data set of RR intervals.

8. The method of claim 7, wherein the data set contains on the order of about 10^3 to 10^4 sequential RR intervals.

1   9. The method of claim 7, wherein the at least one characteristic abnormality is

2   identified based on at least one of the third and higher moments of the data set.

1   10. The method of claim 9, wherein the at least one moment of the data set includes

2   the skewness of the data set.

1   11. The method of claim 10, wherein the illness is selected from the group

2   consisting of sepsis and necrotizing enterocolitis.

1   12. The method of claim 9, wherein the wherein the at least one moment of the data

2   set includes the kurtosis of the data set.

1   13. The method of claim 12, wherein the illness is selected from the group

2   consisting of sepsis and necrotizing enterocolitis.

1   14. The method of claim 7, wherein the at least one characteristic abnormality is

2   identified based on at least one percentile value of the data set.

1   15. The method of claim 14, wherein the at least one percentile value is the 10th

2   percentile value.

1   16. The method of claim 15, wherein the illness is selected from the group

2   consisting of sepsis and necrotizing enterocolitis.

1   17. The method of claim 7, wherein the at least one characteristic abnormality is

2   identified based on the variance, standard deviation or coefficient of variation of the

3   data set.

1   18. The method of claim 17, wherein the illness is selected from the group

2   consisting of sepsis and necrotizing enterocolitis.

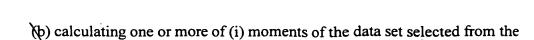1   19. The method of claim 10, further comprising a diagnostic work-up.

1   20. The method of claim 12, further comprising a diagnostic work-up.

1   21. The method of claim 15, further comprising a diagnostic work-up.

1   22. The method of claim 17, further comprising a diagnostic work-up.

1   23. The method of claim 1, wherein a diagnostic work-up is provided when the at
2   least one characteristic abnormality is identified.

1   24. A method for early detection of subacute, potentially catastrophic infectious
2   illness in a patient comprising:
3   (a) continuously monitoring the patient's RR intervals;
4   (b) generating a normalized data set of the RR intervals;
5   (c) calculating one or more of (i) moments of the data set selected from the third and
6   higher moments and (ii) percentile values of the data set; and
7   (d) identifying an abnormal heart rate variability associated with the illness based on
8   one or more of the moments and the percentile values.

1   25. The method of claim 24, wherein the moments include the third moment of the
2   data set.

1   26. The method of claim 24, wherein the moments include the fourth moment of the
2   data set.

1   27. The method of claim 24, wherein the percentile values include the 10th
2   percentile value.

1   28. An apparatus for early detection of subacute, potentially catastrophic infectious
2   illness in a premature newborn infant comprising:

3   (a) a monitoring device, continuously monitoring heart rate variability in the

4   premature newborn infant; and

5   (b) a microprocessor, identifying at least one characteristic abnormality in the heart

6   rate variability that is associated with the illness.

1   29. The apparatus of claim 28, wherein the microprocessor performs the step of

2   generating a normalized data set of RR intervals.

1   30. The apparatus of claim 29, wherein the microprocessor calculates one or more

2   of the third and higher moments of the data set and identifies the characteristic

3   abnormality based on the one or more moments.

1   31. The apparatus of claim 30, wherein the microprocessor calculates the skewness

2   of the data set and identifies the characteristic abnormality based on the skewness.

1   32. The apparatus of claim 30, wherein the microprocessor calculates the kurtosis of

2   the data set and identifies the characteristic abnormality based on the kurtosis.

1   33. The apparatus of claim 29, wherein the microprocessor calculates one or more

2   percentile values of the data set and identifies the characteristic abnormality based

3   on the one or more percentile values.

1   34. The apparatus of claim 33, wherein the microprocessor calculates the 10th

2   percentile value of the data set and identifies the characteristic abnormality based on

3   the 10th percentile value.

1   35. An apparatus for early detection of subacute, potentially catastrophic infectious

2   illness in a patient comprising (1) a monitoring device, continuously monitoring the

3   patient's RR intervals, and (2) a microprocessor, said microprocessor performing

4   steps comprising:

5   (a) generating a normalized data set of the RR intervals;

6   (b) calculating one or more of (i) moments of the data set selected from the

7   third and higher moments and (ii) percentile values of the data set;

8   (c) identifying an abnormal heart rate variability based on one or more of

9   the moments and the percentile values.

1   36. The apparatus of claim 35, wherein the microprocessor calculates the third

2   moment of the data set.

1   37. The apparatus of claim 35, wherein the microprocessor calculates the fourth

2   moment of the data set.

1   38. The apparatus of claim 35, wherein the microprocessor calculates the 10th

2   percentile of the data set.